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ABSTRACT

Education is identified as one of the major goals of zoos. Research studies of the educational goals of different audiences associated with zoos and aquaria are reviewed in this report. These audiences include: (1) the zoo staff; (2) volunteers or docents; (3) general community members in formal programs; (4) students (elementary through graduate school); and (5) recreational visitors. The report also discusses the educational components of, and factors affecting, education in zoos, emphasizes the need for visitor research, explains approaches for conducting research on human behavior learning in the zoo/museum/aquarium environment, and reviews problems associated with the commonly employed methodologies of experimental design studies and survey research. It is pointed out that much of the literature that exists is descriptive, appearing almost exclusively in journals and conference proceedings associated with zoos and museums rather than in those of major disciplines such as psychology or sociology. Research studies often involve small numbers, instruments of unknown reliability and validity, and data that cannot be generalized confidently. The more extensive use of naturalistic or nonreactive research measures is recommended. (ML)

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# THE EDUCATIONAL IMPACT OF ZOOS AND MUSEUMS: A REVIEW OF THE LITERATURE

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David Churchman

Zoo and aquarium personnel most commonly think of research in terms such as animal care, captive breeding programs, or behavioral studies. But, as Cheek and Brennan (1976) have pointed out, Homo sapiens, the single species most prevalent in zoos, also is the least studied. Education is one of the four major goals of zoos, suggesting that one focus of such research should be whether and what people learn at zoos.

Although there are one or two earlier works of historical interest, the literature on visitors may be said to begin with Robinson (1928) and Melton's work in the 1930s. In 1964 a comprehensive "Chronological Bibliography of Museum Visitor Surveys" required only three pages in Museum News (de Borhegyi, 1964). Eleven years later an annotated bibliography (Elliot and Loomis, 1975) required thirty-six pages and covered both museums and zoos. In the same year, a bibliographic review gave some order to this literature by reviewing it under eight broad headings (Borun, 1975). Now, a decade later, the literature on visitor behavior alone is sufficient for a separate review.

## Audiences

As educational institutions, zoos and aquariums address the needs of at least five different audiences. There is wide variation in educational goals both within and among them. The first is the zoo staff itself. Zoos now often include

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* I have been able to obtain many of these papers only with the assistance of Judith King of the National Zoo, without whose valuable help this paper would have been impossible.

specialists such as food service staff, pathologists, horticulturalists, graphic artists, nutritionists, educators, librarians, volunteer coordinators, and marketers, and administrators, each with their own very distinct pre- and in-service educational needs, as do the veterinarians and keepers that most people will think of first. Colleges and universities play a hand here, not only in the fairly obvious case of veterinary training, but also in about two dozen schools that offer courses, programs or even degree programs aimed at zoo careers (Sammarco, 1985).

The widening purposes of zoos, the increasing value of the collections, changing values regarding wild capture, and the demands of increasingly varied collections are among the reasons that keeper education has become a complex task. Areas of knowledge that provide an important foundation for keepers naturally include topics such as taxonomy, behavior, nutrition and veterinary assistance, but perhaps less obviously include construction, architecture, public relations, administration and finance (Brisby, 1985).

In an effort to identify keeper training materials, Poff (1985) sent questionnaires to 97 zoos, 51 of which responded. Of these, 35 have no formal keeper training program, 14 have a formal program, 11 have their own manual or procedures booklet, 20 follow the AAZPA Training Manual in some way, 19 conduct voluntary or compulsory lectures, 22 have books or articles available and 11 have videotapes or films available. Five of the zoos depend on on the job training but felt it was inadequate. In at least one case, this training recognizes that

keepers are important in educating the public. Keepers are specifically trained to serve as guides at the Phoenix zoo through a course offered by a local community college (Stenson, 1984).

At least three associations address the educational needs of zoo professionals. Both at the local and the national level, the American Association of Zoological Keepers [AAZK] have a number of inservice education projects and a natural concern for career advancement of members. The American Association of Zoological Parks and Aquariums [AAZPA] publishes extensively on topics vital to zoo administrators and sponsors an advanced week-long course on zoo administration. The International Association of Zoo Educators [IZE] provides a forum for exchange of educational program ideas, philosophies and evaluation methods through its meetings and occasional but substantial newsletter. A potentially important development in this area was the meeting yesterday to initiate a Consortium of Aquariums, Universities and Zoos [CAUZ] to promote collaboration among staff of these institutions.

Second, most US zoos have large numbers of volunteers or docents, community members in other professions but with a special interest in animals. Commonly, they begin service as students, graduate to providing a wide variety of needed zoo services including escorted tours for visitor groups and eventually may instruct future docents. Birney (1982) found docent-guided zoo visits to have significant impact on visitor knowledge concerning relatively unfamiliar animals such as cavies and tapirs, but no significant impact on visitor

knowledge concerning either moderately familiar or very familiar animals such as chimpanzees, polar bears, raccoons and badgers, when compared with visitors who read signs or visited unsigned exhibits.

Third, zoos often have formal but popular educational programs for community members in general. These include public lectures, evening or weekend courses, field trips emphasizing local flora and fauna, and most ambitious of all, tours to destinations such as Africa or the Amazon. These programs sometimes are offered in cooperation with local universities, sometimes in cooperation with the Zoo and Aquarium Travel Association [ZATA], which promotes conservation through educational travel involving field research (Ashton, 1984).

Fourth, zoos serve students in their communities from elementary through graduate school. While the former may be learning simply to recognize certain animals, the latter often are developing field research skills. Some cities have magnet schools specifically oriented to zoos similar to that in Buffalo, NY (Dailey, 1984) or Los Angeles. Field trips may also involve specialized groups such as severely handicapped or art students, suggesting that it is inappropriate to think of zoos only in terms of science education.

Some operate operate special programs such as day camps (Breuggenan, 1982), summer safaris (Turner, 1983) and a wide variety of imaginative special events (Hartline, 1983). One of the most popular outreach efforts is the zoomobile. A survey of 26 US zoos determined that another popular service, the zoomobile, is served primarily by volunteers; serves nursing

homes, hospitals and schools; and reach 5000-6000 people per year. About half operate only during the school year. The maximum distance and time traveled is about 100 miles or about 2 hours. Half provide free programs, half charge and almost all require external funding of some sort. Programs typically lasts 45-60 minutes. Animals are not tamed or trained for the purpose, and often are non-releasable rehabilitants (Stieg, 1984). Among the important dimensions of zoomobile programs are appropriate vheicles and equipment, whether, on what basis, and how much to charge for programs, what audiences to serve, what kinds of programs to offer, and stress on animals (Schroeder, 1985).

Fifth, recreational visitors are largest in numbers and the most diverse in their makeup and needs. They range from infants in carriers to the elderly, from grammar school dropouts to zoology PhDs, from first-time to frequent visitors. Some visitors spend 5 seconds at an enclosure, some 5 minutes. Some read the signs, some don't. Those who don't may not be able to read, may not read the language of the sign, may never read signs, may have read them on prior visits or may know more about the animal than the sign tells. People learn differently, and they learn different things. Unlike schools, zoos are not called upon to teach the same things to all people (Linn, 1981).

Hill (1971) interviewed 1000 groups consisting of 3562 people to determine the demographics and other characteristics of recreational visitors to the San Diego Zoo. Most were young, well-educated, middle class and with members of their nuclear family. One-third were visiting the San Diego Zoo for the first

time; 42% had visited other zoos in the previous two years. Visitors living in San Diego averaged one visit every 1.83 years; those from southern California averaged one every 3.05 years and the mean for out-of-state visitors was one every 4.01 years.

Educational Components of Zoos

The primary educational component of zoo exhibits are the animals themselves. Learning is both cognitive and affective, and varies among visitors on the basis of their previous knowledge. But, visitors may have arrived with most of the knowledge exhibits are intended to impart (Shettel, 1976) and, worse, may create or reinforce stereotypes or teach visitors that behaviors uncommon in nature are characteristic of particular animals. Sommer (1972) points out that zoo animals often "display sexual aberrations, a heavy incidence of aggression, and the blah-ness common to many animals that don't have anything to do in a concrete cage." Animals in parks have learned that people often throw food to them, so can be seen trotting along behind the trams that take visitors through the parks--not the kind of behavior one would expect from a wild animal (Geddes, 1985).

Animal enclosures are potentially educational. Crandall (1964) believes that making zoo enclosures as much like the natural habitat of animals as possible produces the kind of exhibit that causes the public to be aware of the zoo as a place of learning, while the challenge of finding animals interests many visitors and leads to speculation about the need for camouflage. The recently opened tropical forest exhibit at the

Bronx Zoo probably represents the state of the art with respect to natural exhibits using live animals. But, experienced zoo staff know that some visitors often walk away from such natural exhibits because they cannot find the animals.

A more subtle educational device is the way individual exhibits are grouped. Zoos usually do so according to some principle, such as regions of the world, ecosystems or taxonomy. The only study identified which addresses the extent to which visitors learn anything from exhibit groupings was conducted at the Natural History Museum of the Smithsonian Institution. In this study, Wolf and Tymitz (1978) report visitor comments such as "The exhibit has a flow to it and that helps to show the messages. The hall gave me a feeling that there was a message here. The particular hall being evaluated did in fact involve a number of major themes, including glaciation, periodicity of climate change, sea level changes, giantism, emergence of man, and mass extinction. Clarke (1980) notes three reasons for using architectural devices to guide visitors and group exhibits purposively. First, the nature of science (the ideas of modern biology are abstract and complex). Second, the nature of human memory (which is aided by provision of a context into which information may be assimilated). Third, the nature of perception (which moves from the concrete to the abstract).

Zoos generally group animals together in some way, most often by continent or habitat, although carefully developed themes are rare. The Birmingham (Alabama) Zoo has grouped predators of many types, including insects, big cats and eagles. The Lodi, California Zoo has just opened an exhibit grouping

animals to teach visitors about biological adaptations to tropical forests, and the similar exhibit at the Bronx Zoo already has been mentioned. Most ambitious of all, the Burnet Park Zoo (Syracuse, NY), has just reopened after three years work developing exhibits such as animals as endangered species, extinct animals, animals as social beings and animal adaptations (Aiello, 1984).

The most obvious effort by zoos to educate are signs. After observing people in museums over seven-day spans, 4-5 hours a day, Wolf and Tymitz (1978) report that visitors not only read, but often search for signs, that almost all visitors read some signs but that they read different kinds of things on the signs, and that that no visitor reads all of them. Excluding infants who cannot read, about the only people who read no labels were those who do not speak the language in which the signs are presented.

It is apparent from this that signs should present varied information--scientific, practical, descriptive--to meet the needs of different visitors. Pedagogical theory suggests that labels proceed from simple to complex. But, label content must be altered more than in terms of specificity alone. In other words labels at the most simple level might describe and also identify to stimulate. Labels at the second level might include another kind of learning vehicle such examples or questions. Labels at the third level might state the directions of scientific research or present controversies in the research (Wolf and Tymitz, 1978). Schlegel (1982) discusses such varied strategies as bulletin boards, information booths, and use of

volunteers, slides, films, shows, demonstrations and computers. Gerace (1980) found that sign placement affected reading rates, and Palazzini, et. al. (1985) have suggested that reading difficulty also affects the extent to which signs are read.

Finally, slightly over 100 US zoos maintain book collections, although only about 40 meet the formal definition of a library and only 10 are staffed full-time by trained librarians. Collections cover topics such as zoology, animal behavior, conservation, ecology, zoo management, zoo design, pathology, veterinary medicine, nutrition, botany and horticulture. Aquarium libraries are even more specialized, and have collections that emphasize such topics as seashore biology. Two zoo libraries have map collections, many have slide or photograph collections and several have reprint collections. Many keep archival materials such as keeper diaries. A few circulate notices to alert staff to relevant journal articles, a few are computerizing their catalogs and a small number have access to bibliographic searches on DIALOG. The librarians have a special interest group within AAZPA and a newsletter that has been published three times a year since 1982. (Xenyon, 1985).

Factors Affecting Education in Zoos

Researchers have focused on five factors that affect the educational impact of zoos. First, researchers have collected demographic information on visitors. For example, Wolf and Tymitz (1980) interviewed 743 visitors to the Hirschorn and determined that more females than males visit the museum, that most Black visitors did not live in the area but most White visitors did. Similarly, Shettel (1976) found that the "Man in

His Environment" at the Field Museum in Chicago tend to attract young white adults and mixed males and females, primarily from suburban Chicago or from out of town, and that they came to the museum with most of the knowledge and attitudes the exhibit tended to impart. Linn (1981) suggests, in connection with the issue of whether or not visitors should be recruited, that it would be useful to know something of who does not come.

Second, researchers have addressed the question of how people utilize museums or zoos. Wolf and Tymitz (1978) have approached the issue by developing a taxonomy of four visitor types. These are the "commuter" who was on the way to somewhere else, the "nomad" or casual visitor, apparently open to becoming interested in something without knowing what or quite why he was there, the "cafeteria type" who apparently wants to get interested in something and treats the entire museum as a cafeteria, and the "Very Interested Person" who arrives at the exhibit with some prior interest, and who goes through the hall more carefully than others. They argue that it is inappropriate to say that the exhibit was "better" for the VIP than the others. Exhibits should not appeal only to one kind of visitor: the possibility of stimulating all is important. As Linn (1981) points out, a museum--or zoo--is not like a school. All people do not begin with the same level of knowledge or with the same interests, nor must they all learn the same thing. They do not report where the commuters were going, or the proportion of visitors in each category and there seems to be little if any difference between "nomads" and "cafeteria types." Linn (1981) has suggested that it may (or may not) be appropriate to learn

why people do not come to museums. Kinard (1977) also argues the need to "discover the aspirations, hopes, desires, quests, ambitions, dreams and problems of nonvisitors," although his rationale is based on counterculture notions that fortunately have faded in popularity.

Third, researchers have addressed the way visitors move through museums and zoos. In a series of studies, Melton (1935) discovered a number of generalizations about visitor movement in exhibit halls. The most basic is a right-turn bias, which can be slightly modified by placement of exits and can be overcome by signs whose effectiveness declines rapidly with their distance from entry doors. The bias cannot be overcome by changes in what is exhibited! Therefore, understanding patterns of visitor movement is useful in planning exhibits for maximum effectiveness. It should not be too surprising that the right-turn bias is not as strong as a down-hill bias where visitor paths are not entirely level (Churchman, 1984). These and other factors appear to influence large proportions of visitors to follow similar routes regardless of the exhibits themselves (Andrade, et. al., 1985).

One critical area of need is systematic study of visitor response to controlled variation of exhibit components. Research of this sort would clarify what factors contribute to measurable cognitive gains, help us to understand the nature of visitor reactions, to explore the instructional effectiveness of different types of exhibits, to appreciate the dynamics of visual and interactive learning and to incorporate this understanding into exhibit planning and design. Cameron and

Abbey (1961) argue that generalizable knowledge is needed about visitors' retention (facts), comprehension (ideas), organization (relationship of facts), incorporation (assimilation of facts and ideas) and communication (ability to pass the message on to others). Borun (1977) points out that such knowledge requires comparative studies using data collected in a range of institutions, to distinguish general principles from the effects of specific museum contexts.

Fourth, researchers have addressed the way visitors use their time at museums and zoos. Wolf and Tymitz (1980) found that most visitors to the Hirschorn spend at least two hours in the museum, while a small proportion spend as much as four. Similarly, Falk (1982) reported average time spent in museums by visitors was two hours, but that and only about 30 minutes were spent viewing exhibits. Duration of visits is affected by factors often overlooked by museum staff, such as parking meter limits, bus schedules, hunger, fatigue, lunch hours and appointments.

Some visitors see a large number of exhibits quickly, others concentrate on a smaller number. That is, at any one exhibit, time is bimodally distributed and means are misleading indices (Falk, 1982). Wolf and Tymitz (1978) observed that pairs were more attentive than individuals or groups of three or more, and that the number of people in an exhibit area affects the speed with which later arrivals move through it. Andrade, et. al. (1985) tracked 16 groups for their entire visit to the Los Angeles Zoo. Visits averaged nearly three hours. Mean time

spent viewing exhibits was 64 minutes, walking 63 minutes, eating 20 minutes and other activities 21 minutes.

Fifth, Loomis (1974) argues that more information is needed about the social nature of museum visiting, and that innovative strategies in evaluation and some kind of theoretical framework are needed as well. Traditional experimental methods utilizing treatment and control groups are totally inadequate to such studies because of the number of variables affecting social settings and the large number of interactions (in a statistical sense) among them (Campbell, 1973), which force alternative methods based on observation in natural settings on researchers (Cronbach, 1975). Graburn (1977) approaches this issue from the perspective of the structural anthropologist, arguing that the museum visits mark personal and family life in a memorable way, and make contrasts with work and home that are important in contemporary western culture. Beyond these "associational" functions, he argues that families seek "reverential" and "educational" experiences but that the role of museums (and zoos) with respect to them is ambiguous. Evidence supporting--and qualifying--this view comes from a study of a formal course in animal behavior offered by the Minnesota Zoological Gardens in which adults found the family-oriented parts of the course the most rewarding (Gennaro, et. al, 1980). Wolf and Tymitz (1979) conducted over 300 interviews at the National Zoo, determining that people came to the zoo for for mental and physical relaxation, entertainment, education, and as a family tradition.

Recognition of the social and recreational agenda of family visitors led the National Zoo to develop HERPlab, which stresses hands-on involvement and interaction through materials geared to family groups (White, 1983). Similarly, the Shedd Aquarium found that family members interact with each other more than they attend to exhibits, exploring on a general basis until an exhibit catches the interest of a single member on which all then concentrate. They too implemented programs to achieve educational goals by building on these visitor characteristics (Wilson, 1981).

The Need for Research on Educational Impact

Cameron and Abbey (1961) noted the irony of a profession peopled with scholars that lags behind business in employing the social sciences to understand its market. They suggested that this reflected lack of funds, lack of people qualified to design and carry out such studies, failure to publish those that are done, and condescending attitudes of academics toward studies that sound like those conducted on Madison Avenue. Monroe (1977) suggests slightly different reasons for the lack of research, including a long association with the social and educational elite, a tradition which has stressed repository, research and preservation, lack of adequate financial support, and a proliferation of small museums capable of only the most rudimentary operations. But these factors are changing and the quality and value of visitor experience is becoming a fundamental concern. Several corollaries can be extracted from this axiom: the need for systematic feedback from visitors; the need to understand why visitors learned from, enjoyed and

appreciated exhibits; the need to involve many disciplines in exhibit design and the necessity to define objectives to assure integrated exhibit design.

Washburne (1975) asserts that the collection and preservation function is not sufficient justification for the existence of museums and that they have not met their educational responsibilities because they have failed to prove that they are being achieved. Screven (1976) and others point to the practical information researchers can provide to those responsible for designing exhibits in zoos and museums.

The assumption that increased attendance indicates effectiveness is unwarranted in view of contrary explanations such as increased liesure, higher levels of average educational achievement and greater mobility (Monroe, 1977) Rather, visitor research requires well-defined foci, such as effects, limits and opportunities on visitor perception of architecture and the environment; multiple pathways and levels through the same exhibit for differing visitor interests; identification of design techniques that enhance or obscure visitor awareness of themes, concepts and ideas; and effectiveness of didactic material such as labels, handouts, and graphics (Frye, 1977).

Approaches to Research on Visitors to Zoos

The dominant approaches to conducting research on human behavior and learning today are experiments. Peart (1984) studied the effect of five variations of the same exhibit to determine which had the greatest effect on knowledge gain, attitudinal change, attracting power, holding power and interaction. Kimmel and Maves (1972) used multidimensional

scaling to identify visitor response to systematic changes in museum characteristics such as color, lighting, labelling, number and placement of objects and size and complexity of exhibits.

Despite the dominance of multiple case or comparison group designs, it is worth remembering that experimental psychology originated in single case designs in the work of Wundt, Pavlov and Thorndike. The fundamental requirement is reliance on repeated observations over time. Single case designs are relevant when questions can be answered by frequency measures, rate of response, endurance of response, and the like. Observations can be natural or contrived, field or laboratory, obtrusive or unobtrusive, and often involve alternating baseline and intervention conditions. The order, number or repetitions, and number of interventions can be varied. Data can be analyzed by t- or F-tests to detect differences when separate phases can be identified. Regression and related time-series methods can be used if the data shows serial dependency. Randomization tests can be used when the treatment can be implemented and withdrawn repeatedly. Rank tests can be used with the influence of intervention on behaviors is examined (Kazdin, 1982).

The most common alternative to the experimental design is survey research, which in zoos often is combined with tracking visitors. For example, Kwong (1976) combined trackings and interviews to determine that signs in the lion-tiger exhibit at the National Zoo were read more often if they also had photographs. Wolf and Tymitz (1981) used this approach to determine the general pattern in which visitors moved through an

exhibit hall, noting "magnet areas" where individuals tended to linger, and concentrating their interviews on visitors leaving these. observing and interacting with persons during their visit. Cave and Wolf (1983) assessed effectiveness of Smithsonian Natural History Museum exhibits using unobtrusive observation of a stratified random sample of 200 visitors, 80 of whom were later interviewed.

Despite the general dominance of experiments and surveys they are difficult to do well and effectively in zoos. Random selection is difficult to achieve except under special circumstances and many studies have depended on volunteers, severely limiting the reliability and validity of the results. Manipulating independent variables often requires nothing less than redesigning exhibits, both administratively difficult and prohibitively expensive. Such research often depends on volunteers to complete questionnaires, interviews or tests. But volunteers will not take more than a few minutes or complete tests that may expose ignorance. They are obtrusive and may be reactive--that is, they may change as well as measure behavior. Thus, it is not surprising that Clowes and Wolff (1980) report that traditional pre- and post-test procedures were not particularly successful in obtaining data from recreational visitors. Wolf and Tymitz (1978) suggest limiting interviews to mornings--an important limitation on the method.

Screven (1976) approaches the problem from still another perspective, that of the applied researcher or evaluator. In his view, the major focus of research requires specifying the

desired impacts in advance in measurable learning or performance outcomes, planning exhibits to achieve the desired impacts, collecting research data to determine if the desired impact has been achieved, and revising as necessary. For example, Cone (1978) determined that actual movement of visitors through an anthropology exhibit did not correspond to the logical sequence planned by museum designers.

Rosenfeld (1979) takes issue with this approach because it involves zoo and museum professionals imposing their goals on the public. He advocates a "naturalistic" evaluation that seeks to understand how zoo goers direct and organize their own experience, on understanding the factors that relate to informal learning from their perspective, on their criteria for a successful visit and on how they define learning and what is important to them. Carrying this position to the extreme suggests elimination of all interference with visitors and reliance on nonreactive measures (Webb, et. al., 1981).

Reliance on nonreactive measures, requiring deduction from observation of behavior and traces of behavior, is the approach Sherlock Holmes might take if he had been a psychologist. While no more capable of answering all research questions than any other method, they do have some particularly attractive features for those interested in the educational impact of zoos. Foremost among them is collecting data without interfering with visitors who have come to the zoo to relax, not as the subjects of experiments. Equally important, they permit random sampling with 100% response rates! The price paid for such gains often

is tremendous effort in collecting data and great ambiguity in interpreting results.

The three major types of nonreactive measures are observation, records and physical evidence. The latter usually is divided into erosion and accretion measures.

A classic erosion measure is estimating exhibit popularity in museums by the rate at which the tiles in front of each wear out (Duncan, 1963). More recently, Hoppes (1985) has suggested that the disappearance rate of pads of paper provided to enable visitors to write down the addresses of conservation organizations measure the effectiveness of an exhibit on endangered species.

A classic accretion measure is determining from their garbage whether the rich or the poor are more wasteful of food (Rathje, 1979). Wolf and Tymitz (1981) inferred relative interest in exhibits based on the rate at which they were photographed.

An example of nonreactive observation is Gearing's (1952) study of subcultural awareness in south Chicago using shoe styles to determine lifestyle. In general, the flashier shoe tended to belong to the more culture-bound individual. Visitors to museums and zoos have been followed to determine their routes, counted to determine exhibit popularity, timed to determine whether exhibit signs are read, and eavesdropped on to determine sources of attitudes toward animals--childrens' stories are an important source--and the nature of social interaction among grandparents and grandchildren (Churchman, 1984). Tracking in the National Zoo's reptile house after new

signs were installed determined that mean time spent was 9.7 minutes, the average number of exhibits at which visitors stopped was 19, the average time at each was .44 minutes; on average 14.2 of 92 signs were read (Marcellini, 1976).

An example of the use of records is determining the popularity of specified types of books by the rate at which those with particular call numbers are borrowed from or reshelved by libraries. Both attendance data and book sales provide information on the impact of temporary exhibits, such as the pandas on loan to the Los Angeles Zoo in summer of 1984.

It is worth noting that such methods generally do not violate federal codes for the protection of human subjects (45 CFR 46), nor most university ethics codes which are based on them. Basically, collecting data on behavior in public places does not require consent or notification of subjects if (1) there is no manipulation of behavior and (2) no data can be traced to specific individuals. Those unfamiliar with these regulations or proposing unexcepted research should of course submit planned research to appropriate Institutional Review Boards.

But, Zyzkowski (1981) warns that unless care is taken in their design, such naturalistic evaluations often prove pointless, ambiguous, expensive, and threatening. In this school of thought, measures such as attracting and holding power often equated with a successful exhibit are only prerequisites to learning (Screven, 1979), bringing the argument full circle.

## Conclusion

It is apparent from the preceding that the educational impact of zoos and museums offers fertile and important ground for researchers. Much of the literature that does exist is descriptive; it appears almost (but not quite) exclusively in journals and conference proceedings associated with zoos and museums rather than those of major disciplines such as psychology and sociology; literally millions of people are involved in very different ways. The research studies that do exist often involve small numbers, instruments of unknown reliability and validity, and data that cannot be generalized confidently. Despite this, issues are well-defined, methodological challenges are interesting, and substantive issues are well-defined and theoretically important to broader concerns such as nonformal education, liesure, and sociology of the family.

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